TempoRenal: A Web-Oriented Knowledge-Based System for Renal Monitoring in an Intensive Care Unit

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Renal Function Monitoring. Renal function monitoring has been of key concern at the Institute for Anaesthesiology in Großhadern since the late 1970s.[1,2] Monitoring of the renal function status is based on a set of 66 *renal function parameters* consisting of laboratory data, static patient data and derived parameters. The data are formatted into a lab report. To support the physicians in interpreting the lab reports, the knowledge-based and web-oriented system *TempoRenal* was implemented. *TempoRenal* has to transform this vast amount of data into meaningful, patient-oriented *information*. The system has to perform a set of analyses to diagnose the current renal function status, fluid and electrolyte balance and check for the presence of kidney-specific syndromes. The system has to perform trend analyses to explain the development of the renal function status and possibly to detect subtle deteriorations not apparent from static analyses alone.

System Architecture. The *TempoRenal* system is programmed in Java™. Java programs compile into platform-neutral bytecodes. A Java program can be used from HTML-pages via a tagged structure called „applet" and thus can add dynamic behavior to web documents, and it can be used as a standalone program independant of a browser. The *TempoRenal* software contains the modules **knowledge base**, **patient data**, **„Time Standards"** (for temporal references), **analyses**, **report generator** and **viewers**. The report generator automatically assembles all information and data required for the analyses, controls the execution of the analyses and formats the results both into printed reports and into HTML-documents. Both types of reports contain text and graphical representations.

Reasoning Process. For handling uncertainties, incompleteness and inconsistencies, we use a special configuration of evidential reasoning.[3] For temporal reasoning, we have combined the *Time Standards for Health Care Specific Problems*[4] for representing temporal references with key ideas from the *Trend Templates*[5] for representing patterns of trends. Trend recognition consists of applying evidential reasoning to map a time series to a trend pattern.

Web Orientation. While the printed reports are delivered directly to the units, the corresponding HTML-documents can be inspected via the hospital intranet. Key items of the HTML-documents are hyperlinked to *TempoRenal's* knowledge base that can be consulted with the knowledge base viewers. Renal function monitoring requires subtle interpretation of complex constellations of data under the constraints of an intensive care unit. The knowledge base serves as a source of reference to the less experienced clinicians and it increases the transparency of *TempoRenal's* results.

Evaluation. *TempoRenal's* results have been validated using a set of 103 test cases. Current investigations focus on the educational and awareness effects that the availability of the *TempoRenal* system has on physicians with respect to renal function monitoring.

References

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1091—8280/97/$5.00